

ENVIRONMENTAL ASSESSMENT APOLLO/SATURN V CENTER

KSC
Brevard County, Florida



National Aeronautics and Space Administration
Kennedy Space Center, Florida 32899

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Final Report

ENVIRONMENTAL ASSESSMENT

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The purpose of the proposed action is to increase awareness of Kennedy Space Center visitors to NASA's manned space program, enhance the existing KSC tour, and protect the Saturn V launch vehicle from exposure to Florida weather. To achieve these goals, an Apollo/Saturn V Center will be constructed to house and protect the Saturn V launch vehicle currently on display in an open area adjacent to the Vehicle Assembly Building. In addition to housing the Saturn V rocket, the Firing Room and Lunar landing presentations will be relocated from the Flight Crew Training Building to a common facility complex with the Saturn V rocket. The Apollo/Saturn V Center will be a 137,800 square foot facility .

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1. SUMMARY AND CONCLUSIONS

1.1 Summary

The environmental impacts of construction and operation of the proposed Apollo-Saturn V Center at two proposed sites were investigated and reported in this Environmental Assessment document. A "No Action Alternative" was also investigated. The Apollo-Saturn V Center will house the existing Saturn V vehicle on display at the VAB. The No Action Alternative leaves the vehicle at this location. Alternative 1, the preferred alternative, involves construction of the facility at the existing VIP viewing stands on the Banana Creek. Alternative 2 involves construction of the facility adjacent to the existing VIC on the NASA Parkway.

1.2 Conclusions

Two sites were investigated for potential environmental impacts. Keeping the Saturn V vehicle at its present site was also investigated. No significant impacts from operation of the Center at either site were determined. Infrastructure needs will need to be addressed if the Center is located at the preferred alternative on Banana Creek. Continuing traffic, security and safety impacts will result from keeping the vehicle at the present location at the VIB.

2. PURPOSE AND NEED

2.1 Purpose

The purpose of the proposed action is to increase the awareness of Kennedy Space Center (KSC) visitors to NASA's manned space program, enhance the existing KSC tour, and protect the Saturn V rocket from exposure to Florida weather. To achieve these goals, a Saturn V Gallery will be constructed to house and protect the Saturn V rocket currently on display in an open area adjacent to the Vehicle Assembly Building (VAB).

In addition to housing the Saturn V rocket, the south end of the gallery will house the upper 48 feet of the actual Saturn V Launch Umbilical Tower (LUT), including the hammer head crane at the top of the LUT. At the lower level of the LUT will be the Swing Arm complete with White Room. The White Room will be mated to a gleaming white Apollo Capsule.

The LUT, with its Swing Arm and White Room will provide visitors a passageway to theaters which present the Firing Room and Lunar Landing shows currently housed in the Flight Crew Training Building.

Future expansion will include an exhibit featuring the theme "Return to the Moon." Visitors will pass through this exhibit area as they leave the theater presentations.

The proposed action is referred to as the Apollo/Saturn V Center. The objective of the entire project is to improve public awareness of the U.S. Manned Space Program. The guest who visits the Apollo/Saturn V Center is more likely to exhibit a positive response than non-visitor. The Apollo/Saturn V Center should stimulate a deep, lasting, positive response to Manned Space Flight.

2.2 Need

Secondary objectives of the proposed action deal directly with the visitor program at KSC. this program needs adjustment for the following reasons:

Public Demand: The present bus tour turns away more visitors each year, thus denying them the access to their space program mandated in NASA's charter. The expanding visitor attendance in Central Florida is expected to increase. Within 10 years, KSC will only be able to accommodate just a small percentage of the public demand, unless steps are taken to expand capacity.

Artifact Preservation: The Saturn V rocket has been exposed to the Florida weather for 20 years and is deteriorating rapidly. This rocket was one of only three flight ready spares, and therefore is a national treasure which should be preserved. The LUT has also suffered considerable deterioration from 20 years of exposure to the Florida weather elements. Through this project, both the Saturn V Rocket and the upper 48 feet of the LUT will be restored to the degree necessary for exhibition and then housed in an indoor environment so they are protected for deterioration in the future. These artifacts which played such a significant role in accomplishing the Apollo Mission objectives will be available for numerous future generations of guests to KSC to view and develop an appreciation and understanding of manned space flight.

KSC Operations. The present bus tour impacts KSC operations in two sensitive areas: the Flight Crew Training Building and the parking lot of the VAB. The proposed action will

consolidate and relocate the artifacts at these two stops, creating one new tour stop. In addition to eliminating substantial bus traffic and tourist foot traffic, it will ease safety concerns arising from the present proximity of tourists to the solid rocket fuels, etc., present in the VAB.

Space Constraints. The current presentation of the Apollo story at the flight crew training building is less effective than it should be primarily because of the tight spaces where it is now located. It creates difficulties for presentation and a serious bottleneck limiting the number of visitors who can take the bus tour on peak days. Considering the importance of this event in the history of NASA, the USA and the world, this presentation should be world-class and available to every visitor.

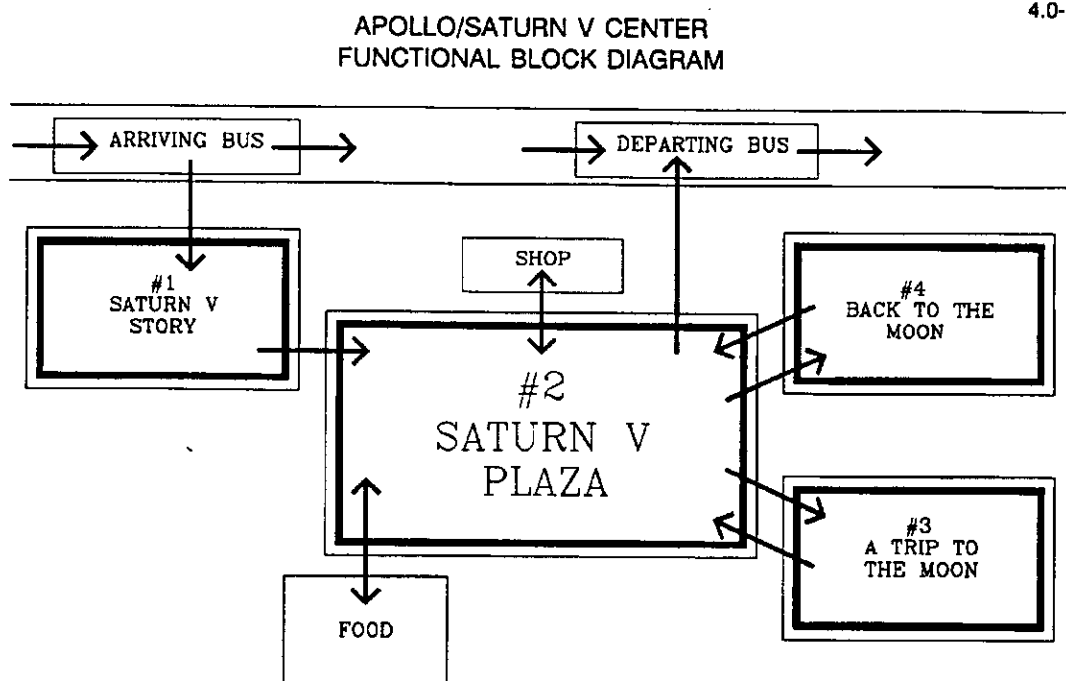
3. DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

3.1 General

The following sections describe the proposed action and details for each of the alternatives examined. Three alternative sites were investigated for the Apollo/Saturn V Center. Alternative 1, the preferred alternative is the Center located on a site adjacent to Banana Creek approximately 1/2 mile north of the VAB. Alternative 1 is the Center located immediately east of the existing Visitor Information Center (VIC) on a producing citrus grove. The no action alternative involves leaving the Saturn V rocket at the existing location at the VAB without any improvements to the facility. The location of these alternatives are illustrated in Figure 3-1.

3.2 Proposed Action

The Apollo/Saturn V Center will be a 137,800 square foot facility which will include the 45,000 square foot Saturn V Plaza for housing the rocket, the 36,000 square foot Trip to the Moon exhibit, the Saturn V Story exhibit, Back to the Moon exhibit and other administrative and support facilities. The conceptual layout is illustrated below.



The proposed main floor plan is illustrated in the following diagram. The design is based on an estimated visitor flow of 2400 per hour..

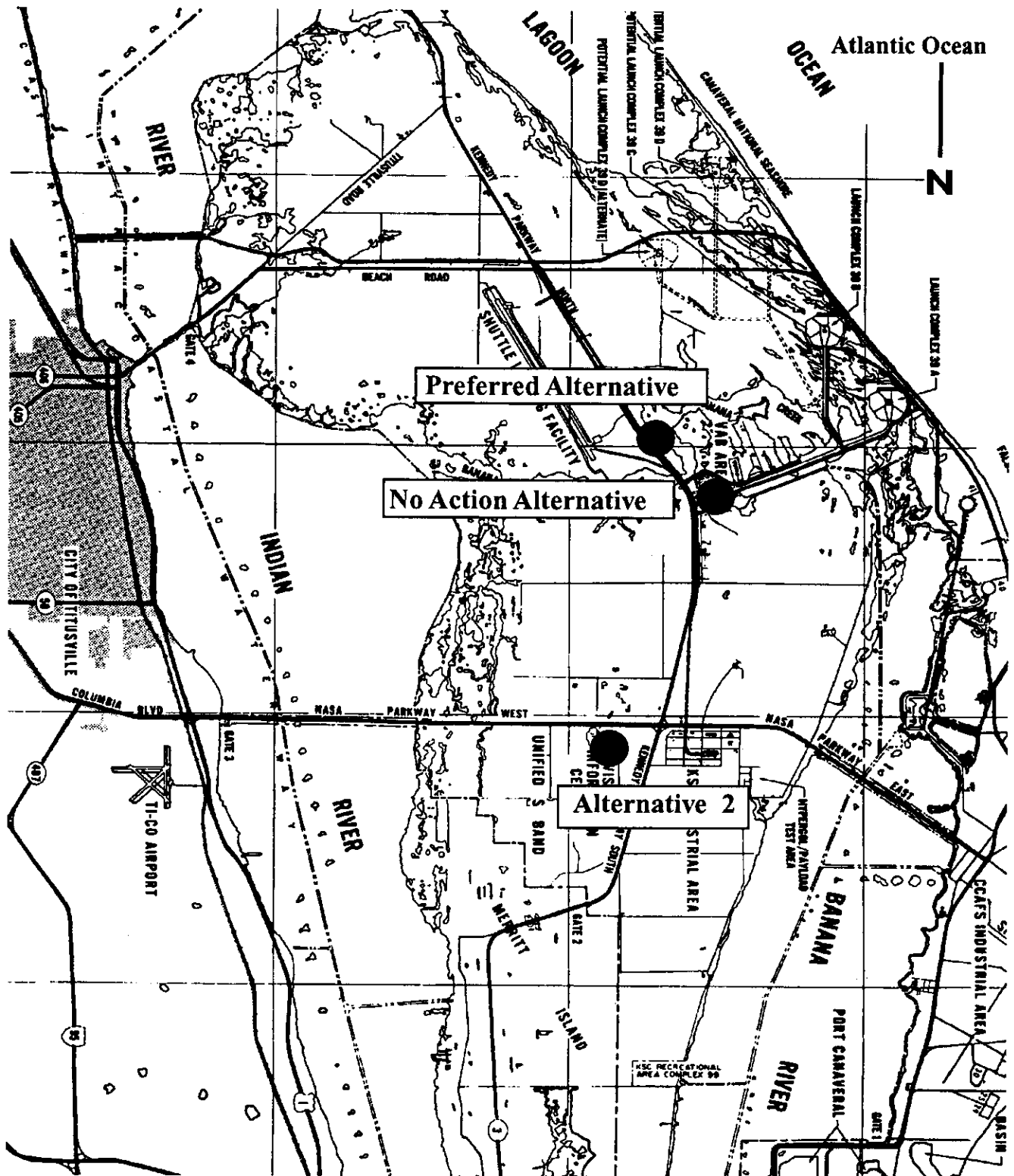
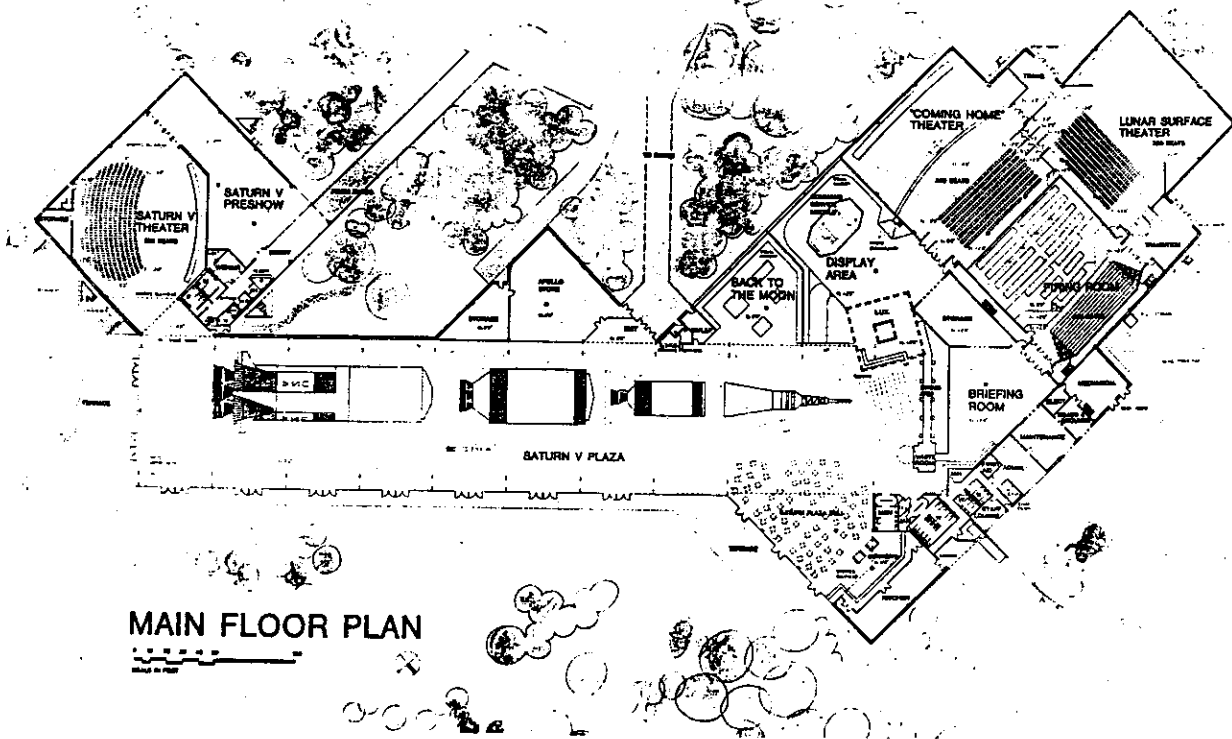


Figure 3-1.
Location of Alternative Sites for the Apollo/Saturn V Center
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The storyline flow and the functional block diagrams initially generated for the project have formed the basis for the building plan. The planning has also been responsive to the following:

- a) Siting so as to retain virtually all of the VIP launch day facilities as currently being upgraded,
- b) Ease of expanding non show elements such as retail and food, and
- c) Ease of phasing the construction of various parts of the facility.

The following is a tentative schedule for design and construction of the facility.

March - October 1992	Detailed Design
November 1992	Design Approval
December 1992 - June 1993	Construction Documents
June - September 1993	Approvals
September 1, 1993	Start Construction
December 1993	Move Rocket
July 1994	PR Event
February 1995	Opening Date (Soft)

June 1995..... Exhibit Installation

July 1995 Formal Opening

3.3 Alternative 1 (Preferred Alternative)

The Preferred Alternative is the location of the Center on a 20 to 25 acre site on Banana Creek currently used as the NASA/VIP and Astronaut Family Member viewing site during launches of the shuttles (Figure 3-2). This function will continue during construction and remain after the completion of the Center. Access, ample area for bus unloading and loading, outdoor wooded natural landscape spill zones, and excellent views of launch pads A and B are all amenities readily available on this particular site.

The site is bounded on the west by a NASA rail line. To the north is Astronauts Road leading to the Shuttle Return Runway and the launch Tracking Camera Stations. Located just south of the proposed Center are the existing bus parking area and Public VIP viewing stands for several thousand launch spectators. Banana Creek forms the eastern boundary of the site.

The Center will be placed at the northwest corner of the site in a diagonal configuration which will hide the Saturn V rocket from view of arriving visitors, thus maximizing the dramatic impact as they discover it after viewing the introductory film. The bus arrival and departure loop will be located to the southwest of the building providing easy access and egress during operational hours. Service and employee parking areas for the facility will be located at the northeast corner of the building and completely screened from public visitor view.

An open view area from the southeast end of the building to pads A and B allows for the family viewing site and vista. The immediate families will view the launches from a 2nd floor level VIP lounge. Extended family and friends will view launches from and outside terrace on the southeast end of the building.

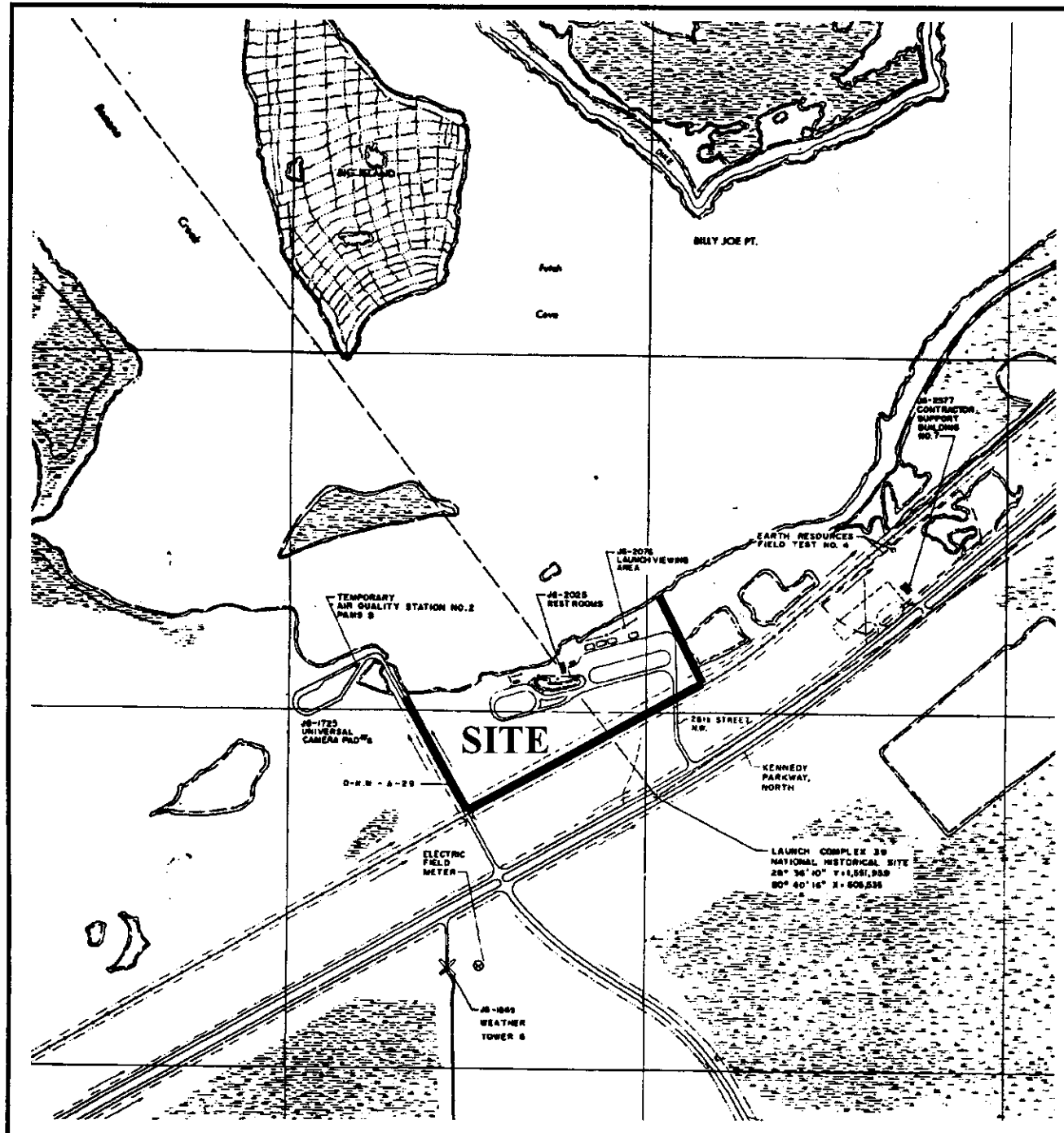
The current on-site land uses include parking and retention areas for the existing VIP viewing area, stands of pines and oaks and a small wetland area in the northwestern part of the site connected to Banana Creek through a narrow, vegetated ditch. A small grove of citrus trees is found between the existing parking lot and Banana Creek.

3.4 Alternative 2

Alternative 2 involves locating the Center adjacent to the existing VIC facility on lands currently under citrus cultivation (Figure 3-3). The alternative 2 site is approximately 40 acres in size and is located immediately to the east of the VIC and is bounded by NASA Parkway to the north, the VIC to the west, citrus groves to the south and vacant lands to the east. The entire site is surrounded by drainage ditches with standing water. Three small forested wetlands under 5 acres in size are located within the site. Two are connected to the drainage ditches.

3.5 No Action Alternative

This alternative leaves the Saturn V rocket at its present location at the VAB with no improvements to the rocket or the facility (Figure 3-4). Problems inherent with this alternative include continued traffic congestion at the VAB complex and the further deterioration of the rocket.



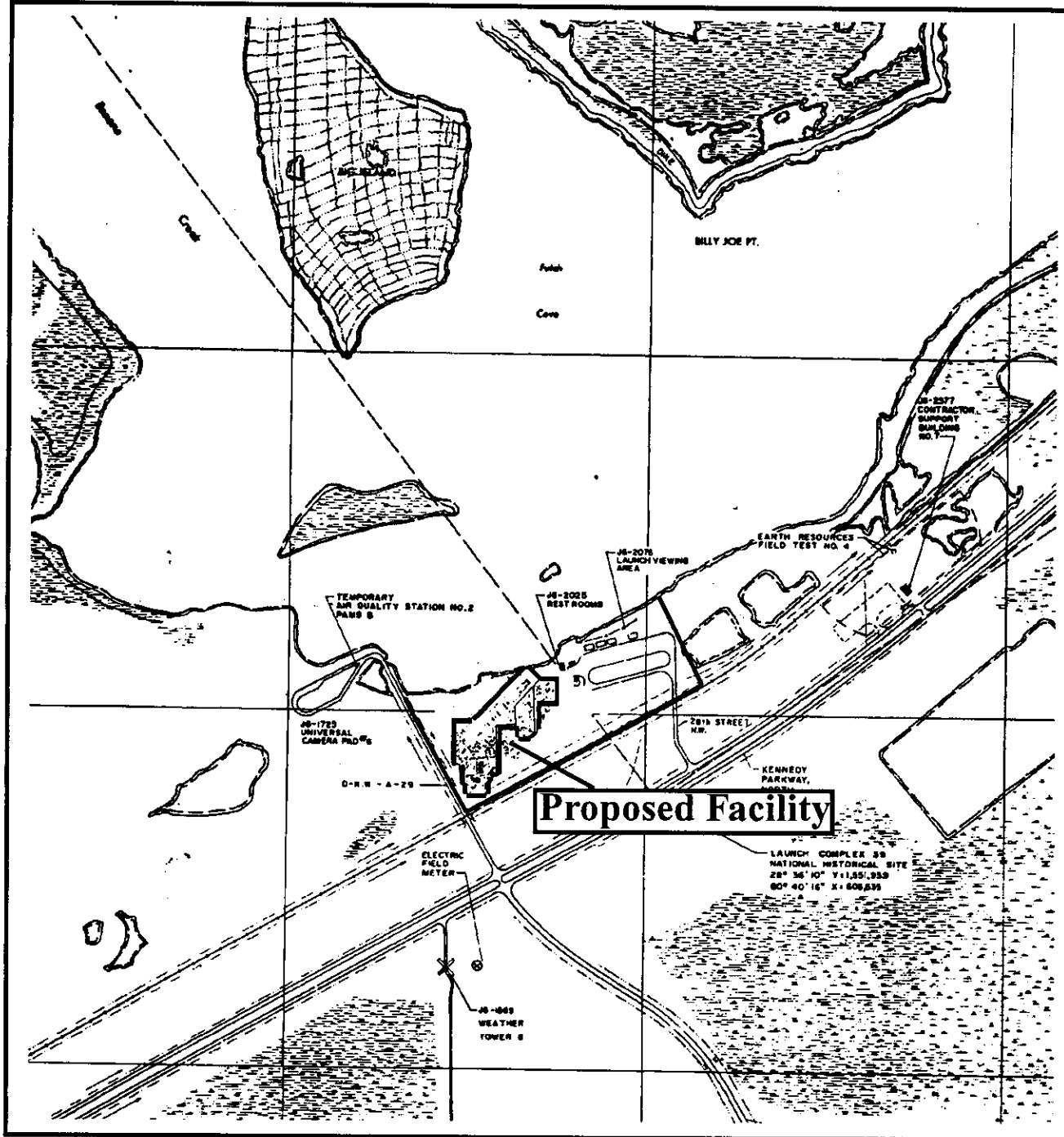
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Figure 3-2.

Detail of Proposed Site Apollo/Saturn V Center

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Figure 3-2A.
Site Plan Placement at the Preferred Alternative
Apollo/Saturn V Center

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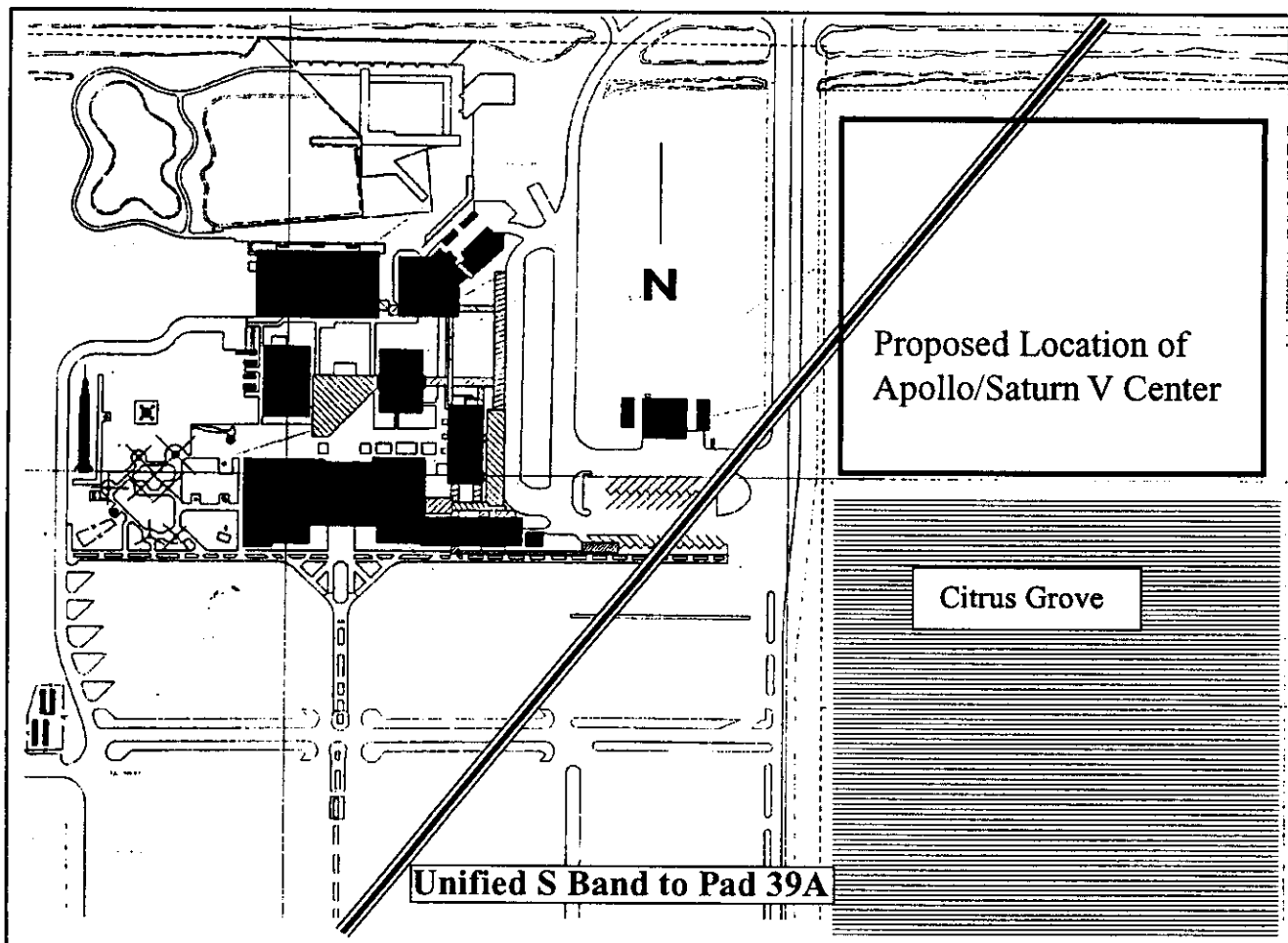


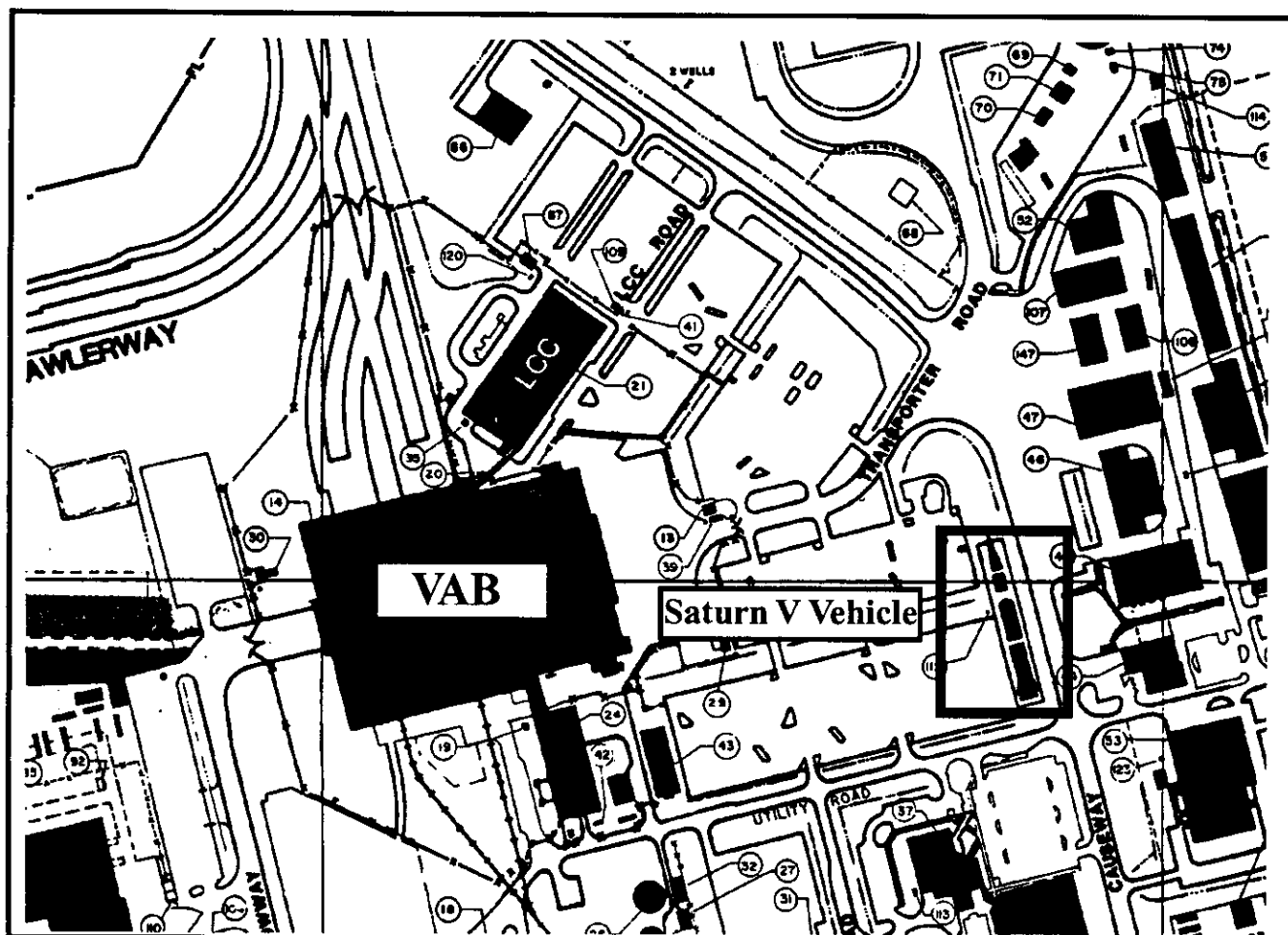
Figure 3-3

Detail of Alternative Site 2-Visitors Information Center

Apollo/Saturn V Center

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Figure 3-4.

Detail of No Action Alternative-VAB

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4. DESCRIPTION OF THE AFFECTED ENVIRONMENT

4.1 General

All three alternatives being considered are located on KSC property. The following information on KSC is derived from the Environmental Resources Document, KSC-DF-3080 dated November 1986 and from the draft Environmental Resources Document dated August 1991. KSC is the principal site for launches of NASA space systems and comprises approximately 140,000 acres of land and lagoon waters. The center is located 150 miles south of Jacksonville and 40 miles due east of Orlando on the north end of Merritt Island adjacent to Cape Canaveral.

KSC is relatively long and narrow, being approximately 35 miles in length and varying from 5 to 10 miles in width. It is bordered on the west by the Indian River Lagoon National Estuary and on the east by the Atlantic Ocean and the Cape Canaveral Air Force Station. The northern most end of the Banana River lies between Merritt Island and the Air Force Station. The southern boundary of KSC runs east-west along the Merritt Island Barge Canal which connects the Indian River with the Banana River and Port Canaveral at the southern tip of Cape Canaveral. The northern border lies in Volusia County near Oak Hill across Mosquito Lagoon.

Merritt Island is a barrier island and is composed of relict beach ridges on the eastern side of the island, creating an undulating surface topography. The troughs are near sea level, and the ridges rise to a maximum of about 10 feet above sea level. The western side of Merritt Island is near level with an elevation of 4 feet above sea level near the center of the island to approximately 0.5 feet above sea level at the Indian River shoreline. Lower elevations on the west is a result of erosion forces smoothing out the beach ridges as the island's deposition progressed from west to east. Surface deposits on Merritt Island are of Pleistocene and Recent ages consisting primarily of and sandy coquina (a coarse grained, porous limestone composed principally of mollusk shell and coral fragments). Differences in landscape position, drainage, and age have produced a wide variety of soils.

The surface drainage pattern of Merritt Island is multibasinal. Surface drainage is typically internal, being trapped in the ponds, lakes and sloughs, burrows and man-made canals on the Island. External drainage is most prevalent in the developed areas, and surrounding uplands adjacent to the bordering bodies of water via man-made drainage systems and by way of grove management pumps to the Indian River.

4.1.1 Air Quality.

The ambient air quality at KSC is influenced by NASA operations, land management practices, vehicle traffic, and emission sources outside of KSC. Daily air quality conditions are most influenced by vehicle traffic, utilities fuel combustion, standard refurbishment and maintenance of operations, and incinerator operations. Air quality at KSC is also influenced by emissions from two regional power plants which are located within a 10 mile radius of KSC. Space launches, training fires, and fuel load reduction burns influence air quality as episodic events. A summary of air source emissions from KSC is presented in Table 4-1.

Table 4-1

KSC Emission source Inventory 1990

SOURCE	EMISSIONS (TONS)					
	HC	CO	NO _x	SO _x	PM	Other
Mobile Vehicle Emissions [1,4]	40.4	422.5	31.5	--	--	--
Utility Fuel Combustion [2]	1.16	5.69	24.98	47.47	2.27	--
Hypergolic Propellants Incinerator [2]	0.2	0.13	1.52	0.42	0.03	--
Pathological Incineration [2]	0.008	0.026	0.008	0.007	0.028	--
Aircraft Exhaust [4]	2.9	4.1	2.2	--	2.5	--
Launch-space Transportation system [1,4]	--	1.3	24.8	--	555.6	34.7HCl
						39.7Cl ₂
Venting-Evaporation [4]	--	--	--	--	--	43.5VOC
Fuel Load Control Burning [3]	669	3900	111	--	470	--
TOTAL	2289.2	13492.1	469.5	111.8	2142	--

[1] Based on 9 launches of Space Transportation System

[2] Based on 1990 consumption

[3] Based on 1990 burn of 6,200 acres at KSC by USFWS

[4] Bionetics Corporation, Air Quality Summary and Monitoring Status at John F. Kennedy Space Center

Ambient air quality at KSC is monitored (MD/RES-Bionetics) by one Permanent Air monitoring System (PAMS) station. PAMS A is located at the Environmental Health Facility site

During the first quarter of 1990 there were no exceedances of either the primary or secondary air quality standards for O₃, CO or SO₂. There were no exceedances for the second quarter of either the primary or secondary air quality standards for CO, SO₂ or NO₂. An exceedance of the O₃ primary standard occurred on June 16, 1990. For the third quarter, there were no exceedances of either primary or secondary air quality standards for O₃, CO, SO₂, or NO₂. For the fourth quarter, there were no exceedances of either the primary or secondary air quality standards for O₃, CO, or SO₂, although O₃ levels were high due to a fire in November to the southwest. NO₂ and SO₂ emissions are related to utilities fuel combustion and mobile sources. Strong correlation between elevated NO₂ and SO₂ levels and prevailing westerly winds indicate that power plants to the west of KSC are the primary sources of these emissions.

Although rarely exceeding established standards, ozone (O₃) is the most consistently high criteria pollutant at KSC. There have been 6 exceedances of ambient air quality standards recorded at KSC since 1988 of primary and secondary standards for O₃. Ozone is formed in a series of chemical reactions between oxidant precursors such as VOC's and NO_x in the presence of sunlight.

Potential air emissions from selected KSC sources are shown below in Table 4-2.

Table 4-2

KSC Potential Air Emissions Summary¹

SOURCE	EMISSIONS (TONS/ YEAR)					
	HC	CO	NO _x	SO ₂	PM	VOC
Industrial Area Heat Plant [1,2]	1.7	8.55	37.64	1215.02	3.4	--
VAB Area Heat Plant [1,2]	1.46	7.3	32.3	1002.3	2.9	--
Solid rocket Booster Assembly and Refurbishment Facility [4,5]	--	1.3	5.2	7.4	2.0	163.9
Hypergolic Propellants Incinerator [1,2]	0.47	2.6	9.06	292.42	0.82	--
High Temperature Hot Water Heater [5]	--	0.3	1.3	7.1	0.1	--

- [1] Based on maximum levels of operation under existing permit conditions.
- [2] Adjusted for burning No. 2 Fuel Oil only (EPA AP-42, "Compilation of Air Pollution Emission Factors).
- [4] Construction Permit - New facility which will replace operations currently permitted at VAB.
- [5] Bionetics Corporation, Air Quality Summary and Monitoring Status at John F. Kennedy Space Center

4.1.2 Surface Water Quality.

The surface waters surrounding KSC include portions of the Indian River, the Banana River, Mosquito Lagoon and all of Banana Creek. In addition, there are various minor tributaries which discharge to these waters.

Surface waters surrounding KSC fall into a number of categories developed by the State of Florida which influence the type and extent of impacts. These categories include Class II-Shellfish Propagation or Harvesting, Class III-Recreation and Propagation and Management of Fish and Wildlife, and Outstanding Florida Waters (OFW), Aquatic Preserves. Class II waters establish more stringent limitations of bacteriological and fluoride pollution and the discharge of treated waste water effluent is prohibited. Class III waters standards are intended to maintain water quality suitable for body contact sports and recreation, and the production of diverse fish and wildlife communities. Outstanding Florida Waters designation supersedes other surface water classifications and water quality standards are based on ambient water quality below the existing levels. Any project within OFW must demonstrate that it is clearly in the public interest requirements for non point source runoff control and limitations on the construction of non-water dependent structures. The surface waters adjacent to the Merritt Island National Wildlife refuge have been designated as OFWs. Aquatic Preserves are present in the Indian River lagoon and Banana River, but do not affect KSC operations.

The surface water quality at KSC is generally good. The best areas of water quality are adjacent to undeveloped areas of the lagoon, such as the north Banana River, Mosquito Lagoon, and the northernmost portion of the Indian River. NASA, the USFWS and Brevard County maintain water quality monitoring stations within and at KSC boundaries.

NASA operations are well removed from the Indian River and thus have minimal impact on area surface waters. Active citrus groves which are leased from NASA and which drain to the Indian River offer the greatest potential for non point source loadings from KSC. These potential impacts are somewhat reduced by the presence of mosquito control impoundments which dominate the shoreline.

Water quality in Banana Creek is influenced by non-point source runoff from the Shuttle landing Facility, the VAB area and the Kennedy parkway, as well as from undeveloped areas within the Wildlife Refuge. These sources are, however, relatively small and no impacts to water quality are apparent.

4.1.3 Ground water Quality.

Ground waters at KSC are classified as Class G-II, Potable water use. This classification includes ground water in aquifers which has a total dissolved solids (TDS) content of less than 10,000 mg/l, unless otherwise classified by the Environmental Regulatory Commission. Nearly all ground water at KSC originates as precipitation that infiltrates through soil into flow systems in the underlying geohydrologic units.

There are three aquifer systems underlying KSC: the Surficial Aquifer, the Intermediate and the Floridan. The Surficial aquifer contains freshwater (potable) but is less extensive than the Floridan, the principal artesian aquifer in east-central Florida. the two main aquifers are separated by nearly impermeable confining units and contain three shallow aquifers referred to as the intermediate aquifer system.

The quality of water in an aquifer is dependent on the lithology of the aquifer, the proximity of the aquifer to highly mineralized waters, the presence of residential saline waters in the aquifer and the

presence of chemical constituents in the aquifer and overlying soils. The quality of the water in the Floridan Aquifer is highly mineralized with high concentrations of chlorides due to lateral sea water intrusion , induced lateral intrusion (due to inland pumping), and a lack of flushing from distant freshwater recharge areas. The Floridan Aquifer beneath KSC has been ranked as having a low potential for well field site acceptability by the Brevard County Water Study. Data from the Brevard County monitoring network wells in the Floridan Aquifer at KSC are summarized below. Chloride values greater than 250 mg/l are usually indicative of excessive salinity.

Parameter	Range (mg/l)
Calcium	127-214
Magnesium	92.3-201
Chloride	1250-2750
Sulfate	21.9-170
Carbonates	128-175
Total Dissolved Solids	2716-5263

Because ground waters at KSC are classified as Class G-II, any construction and operation activity which discharges, or has the potential to discharge into Florida's ground waters requires a permit from FDER. Such facilities include percolation ponds, seepage pits, underground storage tanks, injection and drainage wells, livestock waste lagoons, spray irrigation fields, and sanitary landfills. Discharges to ground water at KSC must have ground water monitoring plans and meet primary and secondary drinking water standards or natural ground water quality, whichever is less stringent.

4.1.4 Geology

KSC is located on Peninsular Florida which gradually rose above a larger feature called the Florida Plateau. The Florida Plateau is one of the world's most stable areas and for millions of years it has been basically a carbonate platform on which thousands of feet of limestones and dolomites have accumulated. Lithography, stratigraphy and geologic structure are important controls of ground water quality, distribution of aquifers and confining beds and the availability of ground water.

Soils at KSC generally originated from relict beach ridges formed by the action of wind and waves along the shore and their subsequent denudation as well as deposition in marine estuary environments. Several soil associations are found on KSC and are described below.

The PAOLA-POMELLO-ASTATULA ASSOCIATIONS are nearly level to strongly sloping, excessively drained to moderately drained soils, and are typically sandy throughout their profile. These soils are found on long, narrow ridges usually less than 2 miles wide between the Indian River and the Banana River and along the Kennedy Parkway. Paola soils are nearly level to strongly sloping, excessively drained sandy soils on ridges. Vegetation includes sand pine, scrub live oak, rosemary, and grasses. Pomello soils are nearly level, moderately well drained, sandy soils on broad, low ridges and knolls throughout the flatwoods. These soils formed in thick beds of marine sands. Permeability is very rapid in the upper 50 inches. Astatula soils are nearly level to gently sloping, with excessively drained, sandy soils on ridges. These soils were formed in sandy marine or eolian sediments and are more than 95 percent quartz. Permeability is very rapid throughout the profile. The natural vegetation is scattered scrub oak, and scrub hickory.

The CANAVERAL-PALM BEACH-WELAKA ASSOCIATIONS are nearly level to gently sloping with moderately well-drained to excessively drained soils and are sandy throughout. Canaveral soils are excessively drained and appear on narrow ridges and sloughs parallel to the Atlantic Ocean. The natural vegetation supported by these soils is saw palmetto, scrub oak, and cactus on the ridge, and various salt-tolerant grasses in the slough where soil is poorly drained. Palm Beach soils are excessively drained and appear on dune-like ridges parallel to the Atlantic Ocean. Permeability is

very high throughout, and water table depths average 10 feet. The natural vegetation associated with this soil includes prickly pear cactus, scrub oak, sea oats, and sea grape.

The MYAKKA-EAU GALLIE-IMMOKALEE ASSOCIATIONS are nearly level, poorly drained soils, sandy throughout to a depth of 40 inches. Myakka sands are nearly level, poorly drained soils on broad flatwoods and areas between ridges. Natural vegetation is characterized by slash pine with an understory of saw palmetto and wiregrass. Eau Gallie sands are nearly level, poorly drained soils on broad and low ridges. The natural vegetation is dominated by flatwoods communities.

The COPELAND-WABASSO ASSOCIATIONS are nearly level, very poorly drained to poorly drained and sandy to a depth of 40 inches. Copeland soils are nearly level poorly drained soils on low flats. Limestone or coquina rock may underlie this soil. Natural vegetation includes cabbage palms, live oaks, bay and magnolia. Wabasso soils are nearly level, poorly drained soils on low ridges and flood plains. These soils were formed in sandy marine sediments over loamy materials. Natural vegetation is characterized by slash pine, runner oak, and saw palmetto on low ridges and cabbage palm and live oak in the flood plain.

The SALT WATER MARSH-SALT WATER SWAMP ASSOCIATIONS are nearly level, very poorly drained, saline to brackish soils of variable textures. Marsh soils may be shallow sands over marl or limestone, irregularly stratified mixed sand and shell fragments, silty clays over sand and shell, or deep organic material. Natural vegetation is the salt marsh community. Swamp soils consist of mixed sand and organic material.

4.1.5 Aquatic Communities.

Most aquatic communities typically include freshwater lake and stream systems, brackish water lagoons, open oceans and bays and wetlands. KSC includes a substantial portion of each of these major community types. The Atlantic Ocean and its associated biological system forms the eastern boundary of KSC, while the Indian River Lagoon marks the western edge. Lying in between is the Banana River and associated brackish water marshes and freshwater wetland systems. Wetlands are unique aquatic systems that are typically transitional areas between uplands and open water systems. They are characterized by natural fluctuations of wet and dry conditions resulting in the development of unique wetland-dependent species. Common wetland types at KSC are **hardwood swamps, willow swamps, freshwater swale marshes, cattail marshes, cabbage palm savannas,** and brackish or saline wetlands that include **sand cord grass- black rush marshes and mixed salt-tolerant grass marshes.**

Aquatic communities and their assemblage of flora and fauna come under the regulatory review of numerous local, state and federal agencies. These agencies regulate dredging and filling of and storm water discharge into these aquatic communities and impacts to rare plant and animal species which may be affected by proposed actions. Most wetlands are considered waters of the U.S. and are under the jurisdiction of the Clean Water Act (CWA). A number of Federal agencies administer programs that can potentially affect wetlands and their likelihood for utilization. The ARMY CORPS OF ENGINEERS (ACOE) administers Section 404 Dredge and Fill Permit Program of the CWA. Any activity involving discharges of dredged or fill material in waters of the U.S., including wetlands, requires a permit under Section 404 of the CWA. The U.S. FISH AND WILDLIFE SERVICE (USFWS) has been delegated the responsibility of protecting wetlands and wildlife habitat. As part of their authority under the Endangered Species Act, the USFWS reviews 404 permit applications for potential impacts of proposed projects on protected species. A number of species protected by the Endangered Species Act are dependent on wetlands during some part of their life. The USFWS may require the preservation of critical habitats if necessary to protect protected species. The ENVIRONMENTAL PROTECTION AGENCY (EPA) also reviews 404 permit applications and may veto ACOE intentions to issue permits if in EPA's view the proposed impact

will substantially degrade wetlands, violate applicable water quality standards, or alternatives are found that are less damaging.

The ST. JOHNS RIVER WATER MANAGEMENT DISTRICT (SJRWMD) maintains a regulatory and planning program which focuses on water quantity as well as water quality. The SJRWMD considers wetlands as hydrologically sensitive areas and exerts regulatory jurisdiction over impacts due to the construction of storm water management systems. The Florida Department of Environmental Regulation (FDER) regulates dredge and fill activities within waters of the state.

Specific regulatory and species related issues will be discussed in greater detail for each alternative reviewed.

4.1.6 Terrestrial Communities

Terrestrial communities include upland ecosystems characterized mainly by well drained, acidic, sandy soils. Uplands include pine flatwoods, dry prairies, scrub, high pine and hardwood forests. The biota has developed to withstand fire and dry environments. The PINE FLATWOODS that occur on KSC are dominated with an overstory of slash pine (*Pinus elliotti*) and an understory of myrtle oak (*Quercus myrtifolia*), sand live oak (*Q. virginiana* var. *geminata*), Chapman oak (*Q. chapmanii*), saw palmetto (*Serenoa repens*), *Lyonia* spp. and *Ilex* spp. Pine flatwoods generally occur on Pomello, Immokalee and Myakka soils.

Two types of SCRUB HABITAT occur on KSC. Oak scrub is dominated by myrtle oak, sand live oak, Chapman oak, and saw palmetto. This type of scrub occurs on Paola and Pomello sands. Saw palmetto scrub is dominated by saw palmetto, shrubs such as *Lyonia* spp. and *Ilex* spp., with a few scrub oaks. This type occurs in Immokalle and Myakka soils.

UPLAND HAMMOCKS are dominated by an overstory of live oak (*Q. virginiana*) and cabbage palm (*Sabal palmetto*). Hammocks are closed forests dominated by evergreen species. Cabbage palm hammocks, oak-cabbage palm hammocks and xeric hammocks are the most common upland hammock types at KSC. Understory is dominated by saw palmetto.

Specific regulatory and species related issues will be discussed in greater detail for each alternative reviewed.

4.1.7 Threatened and Endangered Species

Merritt Island supports large and diverse communities of flora and fauna. Much of the island has been maintained in an undeveloped state as a result of protection within the Merritt Island National Wildlife Refuge and the Canaveral National Seashore. A list of federally protected animal species known to occur on the Refuge with their approximate numbers and breeding status appears in Table 4-3.

Table 4-3

Federally Listed Species Occurring on the Merritt Island National Wildlife Refuge

Species	Breed	Peak Population			
		Spring	Summer	Fall	Winter
West Indian Manatee	Yes	50	120	80	50
Southeastern Beach Mouse	Yes	*	*	*	*
Southern Bald Eagle	Yes	15	8	12	20
A. Peregrine Falcon	No	6	0	10	5
Wood Stork	Yes	500	300	250	250
Roseate Tern	No	10 [#]	0	10 [#]	0
Piping Plover	No	10 [#]	0	10 [#]	5 [#]
Florida Scrub Jay	Yes	2500	3500	3500	3000
Kemp's Ridley Turtle	No	103	10 [#]	10 [#]	10 [#]
Loggerhead Turtle	Yes	200	2000	2000	200
Hawksbill Turtle	No	10 [#]	10 [#]	10 [#]	10 [#]
Green Turtle	Yes	150	150	400	150
American Alligator	Yes	2500	3500	3500	3000
East Indigo Snake	Yes	750 [#]	750 [#]	750 [#]	750 [#]
Atlantic Salt Marsh Snake	Yes	500 [@]	500 [@]	500 [@]	500 [@]

* = Population data not available

= Estimated population

@ = No genetically pure specimens found

Fifty-two species of reptiles and 16 amphibian species are known to inhabit the KSC area. Three of the resident species (the American alligator, the eastern indigo snake and the Atlantic salt marsh snake) are federally protected and require special consideration when projects with potential for environmental impact are undertaken. In addition, the gopher tortoise, the Florida pine snake and the gopher frog occur at KSC and are protected by the state of Florida.

KSC and surrounding coastal areas provide habitat for over 300 bird species. Nearly 90 species are resident breeders while over 100 species winter at KSC.

Expansive areas of wetlands and man-made mosquito control impoundments provide ideal feeding, roosting and nesting habitat for over two dozen species of birds. Many of the wetlands within the Merritt Island National Wildlife Refuge are also managed to provide wintering habitat for approximately 200,000 waterfowl.

Uplands at KSC also provide important habitat for many bird species, including the endangered Florida Scrub Jay. Land bird surveys in hammocks and swamps and scrub have highlighted the importance of broad-leaved woodlands and scrub habitat for maintenance of regional avian diversity. A new population estimate for the Florida Scrub Jay of between 1,415 and 3,603 birds is substantially lower than previous estimates of 6,000 to 10,000 individuals Breininger, D.R. 1990). Road kills may be a factor in scrub jay mortality at KSC because cleared roadside areas provide habitat for birds to hunt insects and cache acorns.

There are ten nesting locations within KSC which have been utilized by southern bald eagles in recent years. Bald eagle habitat management guidelines have been established by the USFWS. Activity is prohibited within the primary zone and is restricted within the secondary zone. The primary zone can vary in width from 750 feet to 1500 feet from the nest, while the secondary zone can vary anywhere from 750 feet to 1 mile from the primary zone.

More than 25 species of mammals are known to inhabit the Merritt Island land mass. Only three federally protected mammalian species are thought to inhabit the island: the Florida panther, the West Indian Manatee and the Southeastern Beach Mouse. There have been no sightings nor evidence of panther activity at the wildlife refuge; so its presence is considered unlikely (KSC Environmental Resources Document, 1991).

As much as 15 percent of the total manatee population in the U.S.A. is located within waters immediately surrounding KSC property. To further protect this endangered species the USFWS officially designated the following areas at KSC as Critical Habitat: (1) the entire inland section of water known as the Indian River, from its northernmost point immediately south of the intersection of U.S. Highway 1 and Florida State Road 3; (2) the entire inland section of water known as the Banana River, north of KARS park; (3) and all waterways between the Indian and Banana Rivers (exclusive of those existing manmade structures or settlements which are not necessary to the normal needs of the survival of the species). Aerial surveys conducted since 1977 have shown increases in manatees utilizing the northern Banana River and data indicates that KSC waters continue to provide important habitat.

4.1.8 Historic and Archaeological

Early Indian tribes in the areas within the KSC boundaries left numerous shell middens and burial mounds, the most impressive of which is Ross Hammock on the west shore of Mosquito lagoon, south of Oak Hill. No comprehensive and systematic survey has ever been accomplished of the total area. There have been, however, some isolated studies and surveys conducted over the years.

Archaeological evidence indicates that the area was inhabited by prehistoric Indians at least 3,000 years ago. The first human visitors were probably small bands of nomadic hunters and gatherers who wandered in from the St. Johns River basin, moving about frequently seeking food sources. Shellfish of several types formed a primary element of their diet as is evidenced by the many shell middens which still exist in the area and which have provided scientists with important information concerning their society. While they left few artifacts, it is known that they used spears with chipped flint tips for weapons.

The earliest European explorers to visit the area were the Spaniards. Their first period of influence was from 1513-1763, with the first contact with the Ais tribe made by Ponce de Leon in 1513. Neither Spanish settlements nor missions were known to have occurred in the Cape Canaveral area, though evidence of their occasional passage through the region was indicated by the presence of wild orange groves. Following the first occupation by the Spanish, English settlers moved into the area. Among the earliest were some of Dr. Andrew Turnbull's colonists from New Smyrna who established a settlement at Ross hammock. They are believed to have dug a drainage canal which still exists. The American Revolution brought an end to Britain's influence over its Florida Colonies.

After Florida was ceded to the United States in 1821, it became a territory and shortly thereafter, commerce and settlement began along the coastal areas. Limited agriculture and fishing industries developed, and permanent home sites and settlements were established. Citrus was an important early crop. Sea turtles were captured in the Mosquito lagoon and shipped to northern towns. Another early business was the cutting of live oak trees for use in the construction of naval ships. This activity was centered around Oak Hill.

The extension of Henry Flagler's Florida East Coast Railroad drastically reduced the area's dependence on waterway transportation and opened up the area to further agriculture and fishing industry expansion.

Currently, the Launch Complex 39 area, which includes the Preferred Alternative on Banana Creek and Alternative 2 at the VAB, is designated a National Historical Site.

4.1.9 Flood plains

The 100-year flood plain at KSC is established at the +4 National Geodetic Vertical Datum (NGVD). Approximately 78 percent of the KSC land area is within this designation.

In accordance with Executive Order 11988 "Flood plain Management" and EO 11990 "Protection of Wetlands", KSC has established procedures and planning policies to minimize federal project and operations impacts on flood plains and wetland resources. Any NASA activity which substantially impacts flood plains or wetlands is subject to NEPA documentation requirements. The requirement to prepare an Environmental Assessment insures that all practicable alternatives to the proposed action have been reviewed.

4.1.10 Noise

The 24-hour average ambient noise level on KSC is appreciably lower than the ERA recommended upper level of 70 decibels (dBA). This is on a scale ranging from approximately 10 dBA for the rustling of grass or leaves to 115 dBA, the unprotected hearing upper limit for exposure on a missile or space launch. The backwoods and National Wildlife Refuge areas of KSC are exposed to relatively low ambient noise levels, in the range of 35 to 40 dBA.

Noise generated at KSC by day-to-day operations, space vehicle launches and Orbiter landings can be attributed to six general sources: (1) Orbiter reentry sonic booms, (2) launches, (3) aircraft movements, (4) industrial operations, (5) construction, and (6) traffic noise.

4.1.11 Infrastructure and Services

In addition to the facilities and functions in direct support of flight operations, KSC has a requirement for Base Support Operations. Base Support Operations consist of daily tasks that are required to support the Center. The normal day-to-day operations and occasional one time institutional operation that occur at KSC are governed by published schedules and written procedures incorporating standard industrial methods. Base support operations, as distinguished from launch and landing operations include:

- * Maintenance of Facilities
- * Utilities
- * Shops (including laboratories and the Motor Pool)
- * Roads and Grounds (including sanitary landfill)
- * Waste Management
- * Logistics (liquid fuels and fluids)
- * Emergency Services
- * Visitor Services

Road access to KSC is from SR-3 and the Cape Road from the south, NASA Causeway (SR-405) and the Beach Road (SR-406) from the west, and Kennedy parkway from the north. All roads have control access points which are manned 24 hours per day, seven days per week.

In order to adequately support these functions, KSC awarded the Base Operations Contract to establish a mission contractor fully responsible for management, operation, maintenance, and engineering for KSC utilities, facilities, certain technical and administrative operations, and health, fire and security services. The current Base Operation Contractor is E.G. & G., Florida, Inc.

4.1.12 Socioeconomics

Approximately 40-45 percent of the estimate 18,500 personnel at KSC have positions directly related to the STS and payload processing operations. The remaining workforce is employed in ground and base support, unmanned launch programs, crew training, engineering, and administrative positions. The largest concentration of personnel (approximately 40 percent of the KSC workforce) are stationed in the VAB area. The industrial area is the next most populated area with approximately 36 percent of the KSC workforce. The remaining personnel are stationed at various outlying facilities at KSC and at the CCAFS.

4.1.13 Land Use

KSC is dominated by undeveloped lands. Undisturbed areas including uplands, wetlands, mosquito control impoundments, and open water areas comprise approximately 95 percent of the total KSC

area. Nearly 40 percent of KSC consists of open water areas including portions of the Indian River, the Banana river, Mosquito lagoon and all of Banana Creek.

Developed facilities within the NASA operation area include the Shuttle Landing Facility, the Industrial Area and the VAB area. These facilities comprise more than 70 percent of the NASA operational area.

NASA has broadly zoned the entire KSC into three functional units. These zoning units are: a **LAUNCH IMPACT ZONE**, a **LAUNCH SUPPORT ZONE** and a **GENERAL SUPPORT ZONE**. The Launch Impact Zone extends from the shuttle launch pads to the Launch Impact Line and into the Atlantic Ocean. High sound-pressure levels occur within this zone and personnel are excluded from this zone during launch events. The Launch Support Zone extends beyond the Launch Impact Limit Line to the General Support zone. Only those structures required in direct support of launches are located within this area. Structures in this zone may require special design to provide protection from toxic propellants and other hazards. The General Support Zone extends from the launch support zone to the KSC boundaries. Structures located within this area may be manned and area relatively safe from explosions on the pads, acoustic vibrations, and toxic propellant hazards.

The Preferred Alternative on Banana Creek and the No Action Alternative adjacent to the VAB are located within the Launch Support Zone. Alternative 2 located at the VIC is located within the General Support Zone.

Other special zones clearances relating to lines-of-sight requirements of transmitters, receives, camera pads, and visual observation points may also impact the location of the Apollo/Saturn V Center. These issues will be discussed further in the document.

Although KSC is specifically excluded from the Coastal Zone, any activities which directly affect the state's coastal zone are subject to a determination of consistency with the state's Coastal Management Program. NASA activities at KSC which are likely to require consistency determinations include:

- * Any project subject to state of Florida dredge and fill permitting review,
- * Any point or new non point source discharge to surface waters, or
- * Major industrial expansion or development projects.

The review of consistency with the Coastal Zone Management Program is coordinated through the State Intergovernmental Coordination and Review Process. The Governors Office functions as the single point of contact for the Intergovernmental Coordination and Review Process and coordinates state agency review and response to consistency determination.

Because any action at KSC which directly affects the coastal zone would also be subject to NEPA documentation, consistency review is typically addressed in the NEPA documentation which is submitted to the Governors Office for review via the Intergovernmental Coordination and Review Process.

4.2 Alternative 1 (Preferred Alternative)

The following information describes the environment surrounding the Preferred Alternative of locating the Apollo/Saturn V Center at the 20 acre site on Banana Creek north of the VAB building.

4.2.1 Air Quality.

Alternative 1 is situated approximately 1 mile north of the VAB complex which includes the SRB Rotation/Processing Facility and Surge Building, the Shuttle Vehicle Assembly & Checkout Facility, Space Shuttle Main Engine Shops and the Orbiter Processing Facility. In addition, the VAB complex also houses the VAB Annex Heat Plant which consumes low sulfur No. 2 fuel oil. Actual air emissions of particulate matter (PM), NO_x, SO₂, HC and CO from this plant are less than those allowable in the applicable permits.

The Solid Rocket Booster Assembly and Refurbishment Facility, located approximately 3 miles south of the preferred alternative site, is currently permitted for air emissions resulting from the processing of 48 solid rocket booster (SRB) motors per year. SRB assembly and refurbishment operations involve cleaning, surface preparation, painting and thermal coating applications. SRB assembly and refurbishment operations are responsible for producing the majority of total volatile organic compounds (VOC) emissions at KSC.

Mobile sources of air pollution from vehicular traffic, tour buses, and locomotives can cause elevations in ambient CO, NO₂ and , on occasion, O₃ readings at the PAMS A site, especially resulting from employee traffic.

Despite the above mentioned sources of air pollution, air quality at the Preferred Alternative Site is generally good.

4.2.2 Surface Water Quality.

The surface waters of Banana Creek east of Kennedy Parkway are good to excellent. Since the creek is part of the Merritt Island National Wildlife Refuge, it has been designated an Outstanding Florida Waters (O.F.W.) by the State of Florida.. Areas designated as OFW are afforded the highest protection of any surface waters in the state. As a result, storm water runoff from the proposed project will be subject to additional storm water treatment requirements by the St. Johns River Water Management District (SJRWMD).

4.2.3 Ground water Quality.

Like much of the rest of KSC, three aquifers are found under the Preferred Alternative, the surficial aquifer, the intermediate aquifer and the Floridan aquifer. The surficial aquifer is approximately 30 to 60 feet below the surface and receives direct recharge from the surface above. This immediate recharge characteristic provides waters within this aquifer with a low salinity content and thus high quality. This high quality is maintained by the presence of prime recharge areas to the north and south of the Preferred Alternative site.

Waters of the Intermediate and Floridan aquifers are highly mineralized and saline and thus are of lower quality than the surficial aquifer. This characteristic, due in large part to salt water intrusion, limits waters within these aquifers for potable and irrigation water supplies.

4.2.4 Geology

The geology of site is typical of Merritt Island with Pleistocene and Recent Deposits occurring to a depth of 30 to 45 feet and containing the surficial aquifer, and the Pliocene and Upper Miocene Deposits occurring between 40 and 100 feet below the surface. The Hawthorn Formation, the principal confining unit of the Floridan aquifer occurs from 100 to approximately 150 feet below the surface. Below this layer the Ocala Limestone and Eocene Deposits that contain the Floridan aquifer are found.

The site is located within the Paola-Pommello-Astatula soil association, which is classified as nearly level to strongly sloping, excessively drained and moderately well drained soils, sandy

throughout. These are soils of the "sand ridges." Paola fine sand, PFB, is the dominant soil type which is an excessively drained soil on ridges. The water table is below a depth of 10 feet.

4.2.5 Aquatic Communities.

Banana Creek is the major aquatic community that may be affected by the proposed project. The West Indian Manatee and the American Alligator would be the only protected aquatic species found in the Banana Creek that might be affected by the Preferred Alternative. A forested wetland area less than 1 acre in size and connected to the Banana Creek by way of a vegetated ditch was found on site. This was confirmed through field observation. This wetland would come under the jurisdiction of the ACOE, the SJRWMD and the FDER.

4.2.6 Terrestrial Communities.

Much of the remaining natural area of the site is a scrub oak and pine community that has little evidence of fire in the immediate past. As a result, understory vegetation has become overgrown, limiting the habitat potential for species such as gopher tortoises and scrub jays. that would normally inhabit such areas.

Prime scrub jay habitat is found to the west of the site across the railroad tracks and to the northeast, north of Banana Creek. Although scrub jays may utilize the site for foraging, no nesting has been observed on site.

4.2.7 Threatened and Endangered Species

The West Indian Manatee and the American Alligator are the most substantial threatened and endangered species that are most likely present in Banana Creek. Rare birds such as the brown pelican, wood stork and southeastern American Kestrel most likely utilize the aquatic environment of the area. No rare upland species such as gopher tortoises or scrub jays were found at the site, most likely due to a lack of natural or control burning on the site. The nearest southern bald eagle nest is at least one mile from the site.

No threatened, endangered or species of special state concern were found on site.

4.2.8 Historic and Archaeological

The presently developed VIP Launch Viewing Area, formerly an orange grove, is largely coterminous with a previously recorded archaeological site, 8Br170. The "Opposite Futch Cove Site," as it has been named, was first discovered in 1973 by Richard L. Smith of Florida Technological University, during an archaeological survey of the Space Shuttle Runway Project area. Smith estimated the site parameters at 941 meters north/south by 31 meters east/west, and dated the aboriginal occupation as ranging from Orange through Malabar IIA (St. Johns) times.

In February 1988 Phase II archaeological investigations were conducted by Robert E. Johnson in an effort to determine site integrity and significance as per the criteria of eligibility for nomination to the National Register of Historic Places. Based upon the results of the investigation, the site dimensions were adjusted to 250 meters north/south by 80 meters east/west. The majority of cultural materials were derived from the upper 50 centimeters, with an earlier and smaller deposit occurring from about 40 to 70 centimeters below the surface in the northern portion of the site. Based on the horizontal distribution of artifactual materials, an extensive early to late St. Johns period occupation, circa 500 B.C. to A.D. 1565 was defined for the site area, with an earlier, possibly Late Archaic period (ca. 2000 to 500 B.C.) occupation in the north. Evidence of alter Spanish contact period activity in the form of lead-glazed earthenware fragment and an olive jar sherd was also noted.

As a result of the Phase II study, 8Br170 was deemed eligible for nomination to the Nation Register of Historic Places. given the proposed plans for development of this area, the Opposite Futch Cove site was subsequently subjected to a Phase II mitigative excavation. The results of this investigation are forthcoming.

On March 21 and 22, 1991 Archaeological Consultants, Inc. (ACI) conducted an archaeological survey of the proposed VIP launch Viewing Area at the Preferred Alternative site. The purpose of the study was to locate and assess the significance of any archaeological site(s) present, in accordance with the request by NASA. Two prehistoric period archaeological sites were discovered as a result of this effort, 8Br773 and 8Br774. Neither was found to be a substantial cultural resources, and therefore, no further archeological work is warranted according to ACI mitigate the adverse impact of proposed development. In addition, neither of the sites is considered eligible or potentially eligible for nomination to the National Register of Historic Places, either due to the limited and mundane nature of the site assemblage (8Br773) or because of the degraded condition of the site (8Br774).

4.2.9 Flood plains

The 100 year flood plain is usually defined as having a one-percent chance of occurring in any given year. The 100 year flood elevation at KSC has been established at +4 feet NGVD. Although the 100 Year Flood plain Map of KSC indicates that most of the site is within the 100 year flood plain, the U.S.G.S. 7 1/2 minute topographic quadrangle of the area indicates that most of the site is above the 5 foot contour.

4.2.10 Noise

The site is relatively quiet, with the exception of occasional locomotive horns, jet traffic from the Shuttle runway or noise from the VAB. Noise from these sources is well within appropriate limits for human health and wildlife habitat.

4.2.11 Infrastructure and Services

The site is presently served by the four lane Kennedy Parkway that runs in a north and south direction. A small rest room facility exists on site for VIP spectators. The site currently has electrical, water and sewer service. Waste disposal is currently being handled for the VIP spectator area. Hazardous materials and hazardous waste management are not applicable to the site at the present time.

Additional water and sewer capacity may need to be added for the Apollo/Saturn V Center due to the number of tourists visiting the Center. Electrical capacity may also need to be added depending in available capacity and Center's needs.

No hazardous materials will be generated during the operation of the center, so this issue is not applicable.

4.2.12 Socioeconomics

The VAB area is the largest employment center on KSC. Approximately 40 to 45 percent of the 18,500 KSC personnel work at the VAB complex. There are no human residents on KSC.

4.2.13 Land Use

The site lies within the Launch Support Zone, which extends beyond the Launch Impact Limit Line to the General Support zone. Only those structures required in direct support of launches are located within this area. Structures in this zone may require special design to provide protection from toxic propellants and other hazards.

Although KSC is excluded from the Coastal Zone, it is required to review its activities with regard to direct effects to the coastal zone. Any activities which directly affect the state's coastal zone are subject to a determination of consistency with the State's Coastal Zone Management Program. Because dredging and filling and point source discharges to surface waters (i.e. storm water discharges) will most likely be part of the proposed action at this site, the project will most likely be reviewed for consistency with the Coastal Zone Management Program of the State of Florida.

Another issue relating to land use will be the potential effects of the Center on viewing launches at pads 39A and 39B from Titusville. This potential impact will be addressed in Section 5, Environmental Effect of Proposed Alternatives.

4.3 Alternative 2 (VIC Site)

Alternative 2 places the Apollo/Saturn V Center at the existing Visitor Information Center. The proposed location would be a site directly east of the VIC on lands currently being cultivated for citrus.

4.3.1 Air Quality.

The VIC site is situated approximately one mile to the west of the KSC Industrial Area, which includes Hot water generators burning No. 2 fuel oil. Due to concerns of high SO₂ emissions, NASA utilities converted from No. 6 fuel oil to No. 2 fuel oil (low sulfur) in mid 1985. This modification has substantially reduced potential and actual SO₂ emissions at KSC.

Operations at the VIC do not contribute substantial amounts of air pollution. Although vehicular traffic at the VIC contribute to NO₂, SO₂, CO and suspended particulate matter emissions, on site utilities fuel combustion and emissions carried from commercial power plants to the west also contribute to elevated air pollution levels at KSC and at the VIC.

4.3.2 Surface Water Quality.

The proposed site is surrounded by drainage ditches that ultimately drain into the Indian River by way of surrounding wetlands and marshes. Brevard County has rated the water quality of the Indian River Lagoon at the outfall area as average to transitional. Indian River surface water quality is influenced primarily by the point and non-point source loadings originating from the City of Titusville.

4.3.3 Ground water Quality.

Ground water quality at the Alternative 2 site is much like that under the entire KSC area in which the surficial aquifer is of higher quality due to its influence by direct recharge from rainfall events. Intermediate and Floridan aquifers have high salt contents due to salt water intrusion. Unlike the Preferred Alternative on Banana Creek, the Alternative 2 site is located in an area of lower recharge potential.

4.3.4 Geology.

The Alternative 2 site is located in a relatively flat topographic setting directly west of the dune and slough areas to the east. The site is located in the Copeland-Wabasso soil association which is a nearly level, very poorly drained and poorly drained soil type, sandy to a depth of less than 40 inches. This is a soil of the "hammocks and low ridges."

Anclote sand, An, Bradenton fine sand, Br, and Wabasso sand, Wa, are the primary soils on the Alternative 2 site. Anclote sand is a nearly level, very poorly drained sandy soil in marshy depressions in the flatwoods, in broad areas on flood plains, and in poorly defined drainage ways. Bradenton fine sand, shallow variant, is a nearly level, poorly drained soil that has limestone within a depth of 40 inches. In most years the water table is within a depth of 10 inches for 2 to 6 months and between depths of 10 and 30 inches for 6 months or more each year. Wabasso sand is a nearly level, poorly drained, sandy soil on broad areas in the flatwoods and on low ridges on the flood plains. The water table is within a depth of 10 inches for 1 to 2 months in most years and is within 30 inches most of the time. The soil is flooded for 2 to 7 days once in 1 to 5 years.

4.3.5 Aquatic Communities.

Several small isolated wetlands occur on site. In addition, the site contains a series of drainage ditches that hold water most of the year. The site is also bounded on the north by the major canal that runs along the southern boundary of the NASA Causeway. The American alligator inhabits the larger drainage structures, whereas smaller reptiles, amphibians, and birds utilize the smaller wetlands. The canal systems generally support a substantial wading bird population.

4.3.6 Terrestrial Communities.

The only remaining terrestrial communities on site are those associated with cultivation of citrus crops. Limited natural animal and plant life would be expected within this grove operation.

4.3.7 Threatened and Endangered Species

As mentioned previously, the American alligator inhabits the major drainage pathways in and around the site. In addition, these drainage pathways most likely support foraging wading birds such as the snowy egret, (*Egretta thula*), the tricolored heron, (*Egretta tricolor*), the limpkin, (*Aramus guarauna*), the little blue heron (*Egretta caerulea*), the wood stork (*Mycteria americana*), and the Florida sandhill crane, (*Grus canadensis pratensis*).

4.3.8 Historic and Archaeological

There are no known historic or archaeological sites associated with Alternative 2.

4.3.9 Flood plains

The entire site lies within the 100 year flood plain.

4.3.10 Noise

The most substantial noise sources in and around the site are vehicular traffic and grove management machinery.

4.3.11 Infrastructure and Services

The site is bounded by the NASA Causeway to the north and the existing VIC to the west. The VIC is served by central water, sewer and electrical power. Hazardous materials in the form of herbicides and pesticides are used on site as part of normal grove maintenance practices. Disposal

of these hazardous materials is conducted by the grove contractor in accordance with normal state and federal guidelines.

4.3.12 Socioeconomics

The VIC is another major employment center at KSC. There are no residents on site or associated with the operation of the VIC.

4.3.13 Land Use

The site is currently leased to a citrus grove operator who manages the site for citrus production. The Unified S Band antenna is located southwest of the site. The Center may interfere with transmissions of signals to launch pad 39A (Figure 4-3).

4.4 No Action Alternative (VAB Site)

The No Action Alternative involves leaving the Saturn V vehicle at its present location at the VAB.

4.4.1 Air Quality.

Since the No Action Alternative is located at the VAB complex, air emissions from this facility will be the most influential. The Facility includes the SRB Rotation/Processing Facility and Surge Building, the Shuttle Vehicle Assembly & Checkout Facility, Space Shuttle Main Engine Shops and the Orbiter Processing Facility. In addition the VAB complex also houses the VAB Annex Heat Plant which consumes low sulfur No. 2 fuel oil. Actual air emissions of particulate matter (PM), NO_x, SO₂, HC and CO from this plant are less than those allowable in the applicable permits.

Mobile sources of air pollution from vehicular traffic, tour buses, and locomotives can cause elevations in ambient CO, NO₂ and , on occasion, O₃ readings at the PAMS A site, especially resulting from employee traffic.

Despite the above mentioned sources of air pollution, air quality at the No Action Alternative Site is generally good.

4.4.2 Surface Water Quality.

The VAB complex is situated on Banana Creek. Most of the surface water originating at the VAB drains either directly by way of ditches or indirectly through adjacent marshes into Banana Creek. Despite this drainage, Brevard County rates this section of the river as good to excellent. Banana Creek is designated an OFW and as such, storm water runoff from new projects must meet higher water quality and quantity standards.

4.4.3 Ground water Quality.

Ground water quality is similar to that of the Preferred Alternative and Alternative 2 sites. However, due to the highly industrialized processes going on at the VAB complex, surficial aquifer ground water contamination may have occurred in the past.

4.4.4 Geology

The geologic structure of underlying sediments is similar to that of the Preferred Alternative site. The site is situated within the Myakka-Eau Gallie-Immokalle soil association, which are nearly level, poorly drained soils sandy throughout or sandy to a depth of 40 inches. The dominant soil type is urban land, Ur, which was most likely brought to the site for the construction of the VAB complex.

4.4.5 Aquatic Communities

There are no aquatic communities associated with the No Action Alternative.

4.4.6 Terrestrial Communities

There are no terrestrial communities associated with the VAB complex. The Saturn V vehicle sits on a concrete pad next to a parking lot and a two lane roadway.

4.4.7 Threatened and Endangered Species

The only threatened and endangered species that might utilize the site would be birds that may perch on power and telephone lines throughout the complex.

4.4.8 Historic and Archaeological

The VAB is one of the largest buildings in the world. The VAB is part the Launch Pad 39 Complex which is listed on the National Register of Historic Places.

4.4.9 Flood plains

The VAB complex is above the 100 year flood elevation.

4.4.10 Noise

The loudest noise generated by the industrial activities at the VAB complex will be produced by hydraulic pumps operating within the confines of their enclosures. Other intermittent raised levels of noise will occur during operation of lifting equipment, diesel-powered generators and locomotives, heavy-duty service vehicles, and the Crawler Transporter; by certain sheet metal forming and cutting processes; and by aqua laser removal of residual thermal protection materials from recovered SRBs.

4.4.11 Infrastructure and Services

The KSC complex is served by central sewer, water and electrical services in addition to an adequate roadway transportation network.

4.4.12 Socioeconomics

The VAB complex is the largest employment center at KSC, employing 40 to 45 percent of KSC's 18,500 workers.

4.4.13 Land Use

The No Action Alternative site lies within the Launch Support Zone, which extends beyond the Launch Impact Limit Line to the General Support zone. Only those structures required in direct support of launches are located within this area. Structures in this zone may require special design to provide protection from toxic propellants and other hazards.

5. ENVIRONMENTAL EFFECT OF PROPOSED ALTERNATIVES

5.1 Alternative 1 (Preferred Alternative)

5.1.1 Air Quality.

5.1.1.1 Construction. Airborne particulate matter may increase due to site clearing and preparation activities. Standard construction practices such as regular spraying of exposed areas with water will be followed during the construction process.

5.1.1.2 Operation. The Center is projected to have a capacity of 2400 visitors per hour or 16,000 visitors per day, up from the present 1200 per hour bus tour capacity (8,960 per day). Assuming a dispatch interval of 15 minutes, twenty four (24) double decker bus trips at 100 passengers each will be necessary to achieve the design capacity of 2400 visitors per hour for the Center. Despite this increase in bus traffic, no substantial air pollution is expected from the completed Center. as no on site power generation or industrial activities will be conducted on site.

5.1.2 Surface Water Quality.

5.1.2.1 Construction. Surface water runoff from the construction site will be minimized by ensuring that all runoff is captured prior to discharge into Banana Creek with standard barriers such as temporary ponds and hay bales. Natural buffers of native vegetation will also be utilized near the river to further insure that no runoff enters the creek.

5.1.2.2 Operation. Because the Banana Creek is an Outstanding Florida Water, extraordinary storm water protection measures will be integrated into the project design. These measures will insure that the first 1 1/2 inch of storm water is captured and treated prior to discharge into Banana Creek. Therefore, no substantial impacts are expected.

5.1.3 Ground water Quality.

5.1.3.1 Construction. There should be no change in ground water quality resulting from construction activities.

5.1.3.2 Operation. There should be no change in ground water quality resulting from operation of the Center.

5.1.4 Geology.

5.1.4.1 Construction. Existing soil types may be altered either by excavation or filling to achieve proper site grades and geotechnical stability. These activities should not alter the underlying geology of the site and surrounding areas.

5.1.4.2 Operation. There should be no change to the geology of the site resulting from operation of the Center.

5.1.5 Aquatic Communities.

5.1.5.1 Construction. The small on-site wetland that is connected to Banana Creek by way of a vegetated ditch will be filled for construction of the Center. The small wetland dependent species that inhabit this small wetland will be displaced. No other impacts to surrounding aquatic communities such as Banana Creek due to construction activities are expected.

5.1.5.2 Operation. No impacts to surrounding aquatic communities such as Banana Creek due to operation of the Center are expected.

5.1.6 Terrestrial Communities.

5.1.6.1 Construction. A portion of the on site terrestrial communities such as the scrub and pine will be cleared during the construction of the Center. Animals will be displaced to other surrounding upland scrub areas. Some of the scrub will be preserved as part of the Center's landscaping plan.

5.1.6.2 Operation. Surrounding terrestrial communities should not be affected by the operation of the Center. Fauna within preserved on site terrestrial communities may be impacted due to increased human activities.

5.1.7 Threatened and Endangered Species.

5.1.7.1 Construction. Gopher tortoises are the only protected species that may be impacted by construction activities. Prior to the initiation of construction, relocation permits will be obtained from the Florida Game and Fresh Water Fish Commission for the removal of any on-site gopher tortoises.

5.1.7.2 Operation. No impacts to threatened and endangered species are anticipated during the operation of the facility.

5.1.8 Historic and Archaeological.

5.1.8.1 Construction. Recent archaeological investigations indicate that the land area surrounding the existing VIP Launch Viewing Area has no substantial archaeological artifacts. Construction should not, therefore, adversely impact the archaeology of this area of the Preferred Alternative Site.

Any construction within the VIP Launch Viewing Area will impact the substantial archaeological finds associated with the 8Br170 "Opposite Futch cove Site." If this area is impacted, mitigating measures such as removal of the artifacts or preservation of these artifacts within the Apollo/Saturn V Center should be pursued. Monitoring of the area by professional archaeologists should be conducted during construction of the Center and associated facilities such as parking areas, utilities and storm water management ponds.

5.1.8.2 Operation. No impacts are anticipated resulting from the operation of the Center.

5.1.9 Flood plains.

5.1.9.1 Construction. The site may have to be filled to elevate the site above the 100 year flood elevation. Appropriate engineering practices will be utilized throughout the construction process.

5.1.9.2 Operation. No impacts to the flood plain will be made during the operation of the Center.

5.1.10 Noise.

5.1.10.1 Construction. Noise will be generated from construction machinery during construction of the Center. During periods of construction, noise attenuation is generally not possible. Decreases in efficiency due to such efforts would increase construction costs and the time period over which

the impacts would occur. However, the use of portable sound screens and the strategic placement of stationary machinery, noise could be substantially reduced.

5.1.10.2 Operation. No substantial noise should be generated during the operation of the Center, except for normal bus operations.

5.1.11 Infrastructure and Services.

5.1.11.1 Construction. Because of adequate roads in the area, construction activities should not impact current infrastructure usage or services.

5.1.11.2 Operation. Additional water, sewer and electrical service will be needed for the Center. These services will be provided in conjunction with KSC and most likely tie into the existing facilities at VAB. Based on estimated attendance figures, it is estimated that sanitary discharge will be approximately 48,000 gallons per day and water demand will be approximately 56,000 gallons per day. The facility will require 3000 AMP electrical service.

5.1.12 Socioeconomics.

5.1.12.1 Construction. Employment in the area will increase due to construction workers on the job site. No substantial increases in population are expected outside the KSC area.

5.1.12.2 Operation. Additional service employees associated with the Center will add to the labor force at KSC. Approximately 16,000 visitors will visit the Center each day during. Because these visitors are part of the bus tour and confined to the Center area, no socioeconomic impacts are expected. No other socioeconomic changes are anticipated.

5.1.13 Land Use.

5.1.13.1 Construction. Because the site is located within the Launch Support Zone, construction activities and schedules may have to be modified during launches from Pad 39A and 39B. This activity and its associated facilities are consistent with Florida's Coastal Zone Management Plan.

5.1.13.2 Operation. Visitor operations may have to be modified during launches due to the site's location within the Launch Support Zone.

A study was undertaken to determine whether there would be any adverse effects of the facility on viewing launches at pads 39A and 39B from the Titusville area. View of pads 39A and 39B from the west bank of the Indian River Lagoon between NASA Parkway and SR 405 in Titusville are shown in Figure 5-1. Highlighted in this figure are the specific areas along the Indian River Lagoon where viewers would see the proposed Apollo/Saturn V Facility at its Preferred Alternative site in the foreground. Also illustrated in Figure 5-1 is the location of the Orbiter Mate/Demate Device in the Shuttle Landing Facility. The Orbiter Mate/Demate Device is similar in height to the proposed Apollo/Saturn V Facility and is located in the same line of sight of pad 39A from Titusville.

Based on field observations within the line of sight using a 400 millimeter telephoto lens mounted on a SLR camera, the Apollo/Saturn V Facility will be seen in the direct line of site of pad 39A along a 1250 stretch of the west bank of the Indian River Lagoon in Titusville. This 1250 foot stretch is located in approximately the same area along the lagoon where viewers see the Orbiter Mate/Demate Device in the line of view.

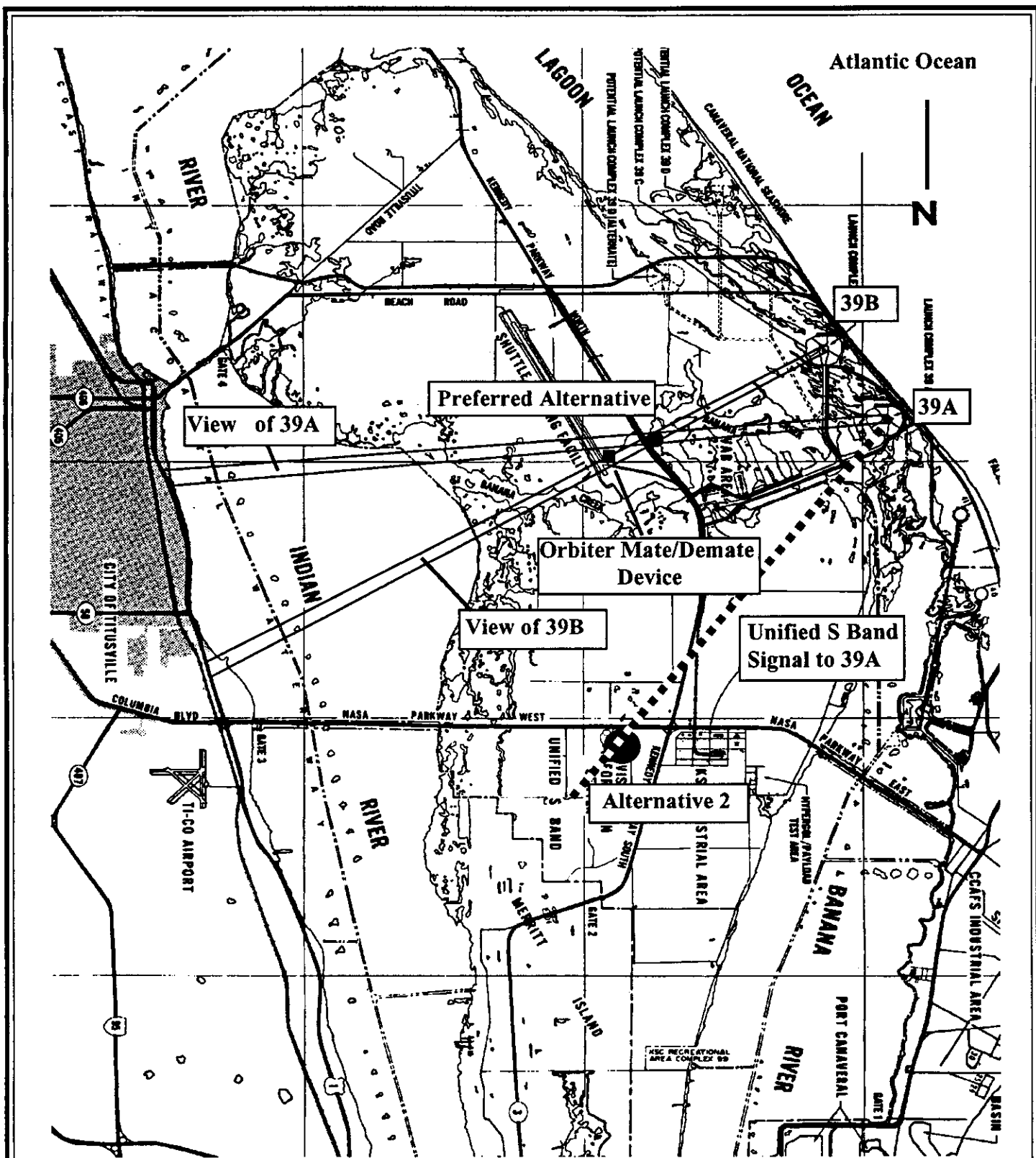


Figure 5-1.
Lines of Sight and Unified S Band Signal Location Relating to the Preferred Alternative and Alternative 2 Sites

January 1992
Natural Systems Analysts, Inc.

The line of sight to pad 39B with the Apollo/Saturn V Facility in the immediate foreground is located farther south, directly north of the NASA Parkway. This 1250 foot stretch is not as critical, since the viewing area is obscured by heavily wooded vacant lands on the west bank of the Indian River Lagoon.

Despite the size of the proposed facility at this location, views of launches from pads 39A and 39B should not be affected. This conclusion is based on 1) the design height of the Apollo/Saturn V Facility, 2) the narrow distance along the west bank of the Indian River Lagoon where views of pad 39A may be affected, 3) the existence of the similarly sized Orbiter Mate/Demate Device in the same line of sight of pad 39A, and 4) the lack of adequate viewing areas in the pad 39B line of sight in which the Apollo/Saturn V Facility would be in the immediate foreground.

5.2 Alternative 2 (VIC Site)

5.2.1 Air Quality.

5.2.1.1 Construction. Airborne particulate matter may increase due to site clearing and preparation activities. Standard construction practices such as regular spraying of exposed areas with water will be followed during the construction process.

5.2.1.2 Operation. No substantial air pollution is expected from the completed Center as no on site power generation or industrial activities will be conducted on site.

5.2.2 Surface Water Quality.

5.2.2.1 Construction. Surface water quality degradation will be minimized through standard pollution abatement practices of using hay bales, sedimentation barriers and buffers.

5.2.2.2 Operation. A surface water management system will be designed and approved by the St. Johns River Water Management District to treat storm water prior to discharge in adjacent waterways.

5.2.3 Ground water Quality.

5.2.3.1 Construction. There should be no change in ground water quality resulting from construction activities.

5.2.3.2 Operation. There should be no change in ground water quality resulting from operation of the Center.

5.2.4 Geology.

5.2.4.1 Construction. Existing soil types may be altered either by excavation or filling to achieve proper site grades and geotechnical stability. These activities should not alter the underlying geology of the site and surrounding areas.

5.2.4.2 Operation. There should be no change to the geology of the site resulting from operation of the Center.

5.2.5 Aquatic Communities.

5.2.5.1 Construction. Several small isolated wetlands may be impacted by the project. These impacts may include filling and/or incorporation into the storm water management system.

Impacts may be reduced or eliminated by adjusting the site plan to avoid these wetland areas. Assuming that these wetlands are filled, the aquatic organisms inhabiting these wetlands will be displaced to other nearby wetland areas. The impact to the small on-site wetland (< 1 acre) will be mitigated as required by the various regulatory agencies such as the FDER, ACOE and the SJRWMD through wetland creating, enhancement or preservation of off site systems.

5.2.5.2 Operation. Once operational the Center should have minimal impact to the surrounding aquatic environments.

5.2.6 Terrestrial Communities.

5.2.6.1 Construction. No impacts to natural terrestrial communities are anticipated since the site will be located in an existing citrus grove.

5.2.6.2 Operation. There should be no impacts to surrounding terrestrial communities which for the most part are existing citrus groves.

5.2.7 Threatened and Endangered Species.

5.2.7.1 Construction. Construction activities will be limited to the citrus grove area and not impact surrounding canals which attract rare wading birds. However, surrounding canals will have to be bridged in several areas, limiting the aerial extent of canal habitat. Construction noise may temporarily keep wading birds away from the site during construction. Since no T & E species permanently inhabit the isolated wetland areas that may be impacted, construction activities will have limited impact on the T & E species of the area.

5.2.7.2 Operation. Operation of the Center will have limited impact on T & E species such as wading birds and alligators, since they are accustomed to human activities at the existing VIC.

5.2.8 Historic and Archaeological.

5.2.8.1 Construction. No impacts to historic or archaeological sites are anticipated since no known historic or archaeological sites are known to occur on the citrus grove.

5.2.8.2 Operation. No impacts to historic or archaeological sites will occur with the operation of the site.

5.2.9 Flood plains

5.2.9.1 Construction. The site may have to be filled to elevate the site above the 100 year flood elevation. Appropriate engineering practices will be utilized throughout the construction process.

5.2.9.2 Operation. No impacts to the flood plain will be made during the operation of the Center.

5.2.10 Noise.

5.2.10.1 Construction. Noise will be generated from construction machinery during construction of the Center. During periods of construction, noise attenuation is generally not possible. Decreases in efficiency due to such efforts would increase construction costs and the time period over which the impacts would occur. However, with some planning the use of portable sound screens and the strategic placement of stationary machinery, noise could be substantially reduced.

5.2.10.2 Operation. No substantial noise should be generated during the operation of the Center, except for normal bus operations.

5.2.11 Infrastructure and Services.

5.2.11.1 Construction. Because of adequate roads in the area, construction activities should not impact current infrastructure usage or services. Based on estimated attendance figures, it is estimated that sanitary discharge will be approximately 48,000 gallons per day and water demand will be approximately 56,000 gallons per day. The facility will require 3000 AMP electrical service.

5.2.11.2 Operation. Additional water, sewer and electrical service will be needed for the Center.

5.2.12 Socioeconomics.

5.2.12.1 Construction. Employment in the area will increase due to construction workers on the job site. No substantial increases in population are expected outside the KSC area.

5.2.12.2 Operation. Additional service employees associated with the Center will add to the labor force at KSC. Approximately 16,000 visitors will visit the Center each day during. Because these visitors are part of the bus tour and confined to the Center area, no socioeconomic impacts are expected. No other socioeconomic changes are anticipated.

5.2.13 Land Use.

5.2.13.1 Construction. This activity and its associated facilities are consistent with Florida's Coastal Zone Management Plan.

5.2.13.2 Operation. The operation of the Center will require that existing leases to operate and maintain the citrus grove operation be terminated. In addition the Center may compromise the operation of the Unified S Band signal to launch pad 39A, depending on the Center's design.

5.3 No Action Alternative (VAB Site)

The No Action Alternative will have minimal impact to the site and surrounding environment since the visitors will continue to view the Saturn V vehicle as it exists while they visit the VAB building. Therefore many of the environmental issues listed below are not applicable to this alternative.

5.3.1 Air Quality.

5.3.1.1 Construction. The No Action Alternative will involve no construction activities.

5.3.1.2 Operation. No changes in tour bus activities are anticipated with the No Action Alternative, since visitors will continue to visit the Saturn V vehicle at its existing location.

5.3.2 Surface Water Quality.

5.3.2.1 Construction. Not applicable.

5.3.2.2 Operation. Not applicable.

5.3.3 Ground water Quality.

5.3.3.1 Construction. Not applicable.

5.3.3.2 Operation. Not applicable.

5.3.4 Geology.

5.3.4.1 Construction. Not applicable.

5.3.4.2 Operation. Not applicable.

5.3.5 Aquatic Communities.

5.3.5.1 Construction. Not applicable.

5.3.5.2 Operation. Not applicable.

5.3.6 Terrestrial Communities.

5.3.6.1 Construction. Not applicable.

5.3.6.2 Operation. Not applicable.

5.3.7 Threatened and Endangered Species.

5.3.7.1 Construction. Not applicable.

5.3.7.2 Operation. Not applicable.

5.3.8 Historic and Archaeological.

5.3.8.1 Construction. Not applicable.

5.3.8.2 Operation. Not applicable.

5.3.9 Flood plains

5.3.9.1 Construction. Not applicable.

5.3.9.2 Operation. Not applicable.

5.3.10 Noise.

5.3.10.1 Construction. Not applicable.

5.3.10.2 Operation. Not applicable.

5.3.11 Infrastructure and Services.

5.3.11.1 Construction. Not applicable.

5.3.11.2 Operation. Normal operations at the VAB will continue to be compromised with the existing tour bus traffic. On-site visitors place a security burden on the VAB operations. In addition, the industrial nature of the VAB complex makes the tour stop a potentially unsafe place for visitors.

5.3.12 Socioeconomics.

5.3.12.1 Construction. Not applicable.

5.3.12.2 Operation. Not applicable.

5.3.13 Land Use.

5.3.13.1 Construction. Not applicable.

5.3.13.2 Operation. Visitor operations may have to be modified during launches due to the site's location within the Launch Support Zone.

5.4 Comparative Effects of Alternatives

The following chart summarizes the various environmental factors associated with each alternative.

Environmental Factor	Alternative 1	Alternative 2	No Action Alternative
<u>5.3.1 Air Quality.</u>			
5.3.1.1 Construction.	None	None	None
5.3.1.2 Operation.	None	None	None
<u>5.3.2 Surface Water Quality.</u>			
5.3.2.1 Construction.	None	None	None
5.3.2.2 Operation.	None	None	None
<u>5.3.3 Ground water Quality.</u>			
5.3.3.1 Construction.	None	None	None
5.3.3.2 Operation.	None	None	None
<u>5.3.4 Geology.</u>			
5.3.4.1 Construction.	None	None	None
5.3.4.2 Operation.	None	None	None
<u>5.3.5 Aquatic Communities.</u>			
5.3.5.1 Construction.	Minimal	Minimal	None
5.3.5.2 Operation.	None	None	None
<u>5.3.6 Terrestrial Communities.</u>			
5.3.6.1 Construction.	None	None	None
5.3.6.2 Operation.	None	None	None
<u>5.3.7 Threatened and Endangered Species.</u>			
5.3.7.1 Construction.	None	None	None
5.3.7.2 Operation.	None	None	None
<u>5.3.8 Historic and Archaeological.</u>			
5.3.8.1 Construction.	Minimal	None	None
5.3.8.2 Operation.	Minimal	None	None
<u>5.3.9 Flood plains</u>			
5.3.9.1 Construction.	None	None	None
5.3.9.2 Operation.	None	None	None
<u>5.3.10 Noise.</u>			

5.3.10.1 Construction.	Minimal	Minimal	None
5.3.10.2 Operation.	None	None	None
<u>5.3.11 Infrastructure and Services.</u>			
5.3.11.1 Construction.	None	None	None
5.3.11.2 Operation.	Minimal	Minimal	None
<u>5.3.12 Socioeconomics.</u>			
5.3.12.1 Construction.	None	None	None
5.3.12.2 Operation.	None	None	None
<u>5.3.13 Land Use.</u>			
5.3.13.1 Construction.	Minimal	Minimal	None
5.3.13.2 Operation.	Minimal	Minimal	None

5.5 Mitigation and Monitoring

Because of the insignificance of the small wetland on site, no mitigation is anticipated. If mitigation is required by permitting agencies, details will be worked out during the permitting process. No long term monitoring requirements are anticipated.

6. REFERENCE INFORMATION

6.1 Agencies and Individuals Consulted

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6.3 Reference Documents

